this feature. Non-recurring costs for providing switch translations at service activation also are included in the study.

Recurring and non-recurring costs also are developed for DS1 trunks in the Unbundled Digital DS1 Trunk Port cost study.

- *Feature-Related Non-Recurring Costs.* There are several studies which develop the costs of activating central office features. These include features available on analog line ports (e.g., custom calling and CLASS features), ISDN port features and Centrex-like features. The studies identify activities, such as performing switch translations, necessary to activate features and the time required to perform the activity. Direct labor rates are used to compute non-recurring costs.

The study documentation for each of these network elements provides details on input cost data, calculations and results. In each case, the general approach described in section 2 is followed. Refer to the individual study documentation for additional information.

Transport Costs

5.1 Study Purpose

Transport refers to cable facilities, circuit equipment and other plant providing communications paths among SWBT central offices. Transport facilities are used to provide *dedicated transport* for private line and other special services and *common transport* for local and toll message traffic. Dedicated transport unbundled network element costs are computed in SWBT's Unbundled Dedicated Transport cost study, and common transport costs are computed in the Common Transport cost study. The studies provide recurring costs and non-recurring costs for service activation of transport network elements.

5.2 Dedicated Transport

The Dedicated Transport cost study calculates the cost to provide network elements for dedicated channels of varying bandwidths and lengths among SWBT central offices. The network elements included in the study are:

- *Entrance Facilities.* Cable and circuit equipment for access from a customers premises to the SWBT serving central office. Access is provided via a dedicated channel with bandwidth at the DS1 level (1.544 megabits / second) or the DS3 level (45 megabits / second or equivalent to 28 DS1 channels). Costs are distinguished for rural, suburban and urban geographic areas (zones 1, 2 and 3, respectively).

- *Interoffice Facilities.* Interoffice (IO) facilities are the cable and circuit equipment between SWBT central offices which provide communications paths among the offices. Fiber optic transmission facilities are assumed. Costs are computed for the DS1 and DS3 bandwidths, as well as for a voice grade dedicated interoffice channel (64 kilobits / second). IO facility costs are computed for each zone and between zones (inter-zone IO facility costs).

  Interoffice facilities require circuit equipment at each central office. Between central offices are cable facilities. The amount of cable depends on the route mileage between offices. Recognizing these factors, the study determines interoffice facilities costs for the "first mile" including the central office circuit equipment, and for each additional mile.

- *Cross Connects.* This network element includes equipment connecting interconnecting carrier equipment to SWBT's transport facilities. Cross-connect costs are computed for voice grade connections (two wire and four wire connections), DS1 And DS3.

- *Digital Cross-Connect System.* A network element which terminates digital transmission facilities operating at standard digital signal rates. The system

automatically connects tributary transmission signals according to a "map" electronically stored in the system. Digital cross-connect system costs are computed for voice grade, DS1 and DS3 terminations.

- *Multiplexing.* The capability of combining multiple transmission channels over the same transmission facilities. Costs are provided for DS1 to DS0 multiplexing (i.e., combining 24 voice grade channels to form one 1.544 megabit channel) and DS3 to DS1 multiplexing (28 DS1s for one DS3).

The results of the study for the two primary network elements, entrance facilities and interoffice facilities, are illustrated in Figure 5.1.

Figure 5.1

Unbundled Dedicated Transport Cost Study Results

Entrance Facilities

	Geographic Zone	Monthly Recurring Cost	Non-Recurring Cost First	Non-Recurring Cost Additional
DS1	1	$XX.XX	$XX.XX	$XX.XX
	2	$XX.XX	$XX.XX	$XX.XX
	3	$XX.XX	$XX.XX	$XX.XX
DS3	1	$XX.XX	$XX.XX	$XX.XX
	2	$XX.XX	$XX.XX	$XX.XX
	3	$XX.XX	$XX.XX	$XX.XX

Interoffice Transport

	Geographic Zone	Monthly Recurring Cost First Mile	Monthly Recurring Cost Add'l Mile	Non-Recurring Cost First	Non-Recurring Cost Additional
Voice Grade	1	$XX.XX	$XX.XX	$XX.XX	$XX.XX
	2	$XX.XX	$XX.XX	$XX.XX	$XX.XX
	3	$XX.XX	$XX.XX	$XX.XX	$XX.XX
	Interzone	$XX.XX	$XX.XX	$XX.XX	$XX.XX
DS1	1	$XX.XX	$XX.XX	$XX.XX	$XX.XX
	2	$XX.XX	$XX.XX	$XX.XX	$XX.XX
	3	$XX.XX	$XX.XX	$XX.XX	$XX.XX
	Interzone	$XX.XX	$XX.XX	$XX.XX	$XX.XX
DS3	1	$XX.XX	$XX.XX	$XX.XX	$XX.XX
	2	$XX.XX	$XX.XX	$XX.XX	$XX.XX
	3	$XX.XX	$XX.XX	$XX.XX	$XX.XX
	Interzone	$XX.XX	$XX.XX	$XX.XX	$XX.XX

5.3 Entrance Facilities Costs

Entrance facilities consist of loop plant from a customers premises to the SWBT serving central office and circuit equipment located at the customers premises and the central office. For a DS1 entrance facility in a rural area, approximately half of the plant investment is cable facilities and half is circuit equipment. In urban areas, about 20% of plant is cable and 80% circuit equipment.

The loop portion of entrance facilities costs is computed in the same manner as unbundled loop costs described in Sections 3.2 - 3.8. The LPVST model is used to compute cable investment per entrance facility. The DS1 cable investment reflects a mix of copper and fiber cables and cable types (aerial, underground and buried). For DS1 entrance facilities, fiber feeder cable is assumed for feeder cable over 6,000 feet. DS3 entrance facilities are assumed to be all fiber.

In addition to the distribution and feeder cables, plant investment is included for the feeder distribution interface, premise termination equipment and frame stringer. These are described in Section 3.2.

Circuit equipment makes up a substantial portion of entrance facility plant investment and costs. Forward-looking circuit equipment designs for copper and fiber entrance facilities are developed. These are called Service Area Function (SAF) designs. For example, the SAF design for DS1 entrance facilities with copper feeder cable calls for use of the following equipment:

- Digital test access units.
- Jack panels.
- Office repeaters.
- Office repeater bay.
- Maintenance terminating unit at the customers premises.

Investments amounts for each equipment item are computed per unit of DS1 capacity. The SAF design uses current vendor material prices and loadings for power equipment, sales taxes and other costs of construction.

A similar SAF design is produced for DS1 and DS3 entrance facilities with fiber feeder cable. The circuit equipment investments for copper and fiber facilities are weighted based on the prospective mix of these cable types to compute average circuit equipment investments. These amounts then are used in ACES along with the cable investments to compute monthly entrance facility costs.

5.4 Interoffice Facility Costs

Monthly IO facility costs are computed for voice grade, DS1 and DS3 channels in rural, suburban and urban geographic zones. Monthly costs for the three bandwidths also are computed for dedicated transport between zones or inter-zone. Costs are calculated for the first mile including circuit equipment in the central office and for each additional mile. Mileage is in terms of air miles between central offices.

Monthly costs include capital costs and operating expenses for the plant (aerial, underground and buried cables, circuit equipment and central office equipment) making up the IO facilities. The total plant investment and mix of plant are based

on actual network characteristics (central office locations, interoffice distances and networks) and the forward-looking, least cost design of IO facilities.[10]

SWBT's COSTPROG model is used to develop IO facility investments for each of the bandwidth - zone combinations.[11] The following is a description of the important aspects of the COSTPROG model for calculating IO facility investments.

- *Inventory of Central Office Pairings.* COSTPROG begins with a complete list of all pairings of central offices in the state for each zone (rural, suburban, urban or inter-zone). The first central office in the pairing is called the 'A' location and the second, the 'Z' location. The model contains the distance between these points in *air miles.*

- *Inventory of Networks.* The model also contains a complete inventory of *networks* in the state. Networks are groups of central offices or network nodes connected by IO transmission facilities. Facilities may be configured in one of three possible SONET designs - a uni-directional ring, a bi-directional ring or a chain design. These are alternative transmission facility designs selected by network engineers depending upon IO traffic patterns. The network inventory is used by COSTPROG to identify possible paths for a dedicated transport channel between A and Z central offices. COSTPROG determines the cost of each possible path and uses the *least cost path* in developing transport costs.

  The descriptive data for each network includes the *type of design* (e.g., uni-directional ring), the *bandwidth of the network* (OC3, OC12 or OC48),[12] the *number of nodes* or locations where traffic can enter or leave the network, the *number of fibers* and *actual route mileage.* Each of these is a *driver* of the circuit and cable investment required to provide the network.

- *Fixed and Per-Mile Investments.* COSTPROG contains tables of SONET circuit equipment and fiber investments used to estimate the current cost of constructing each of the network designs in the network inventory. Separate construction costs are provided for ring versus chain designs, for network access and interconnection, and for the IO fiber cable. Circuit equipment costs vary by network bandwidth (OC3, OC12, etc.), and fiber costs by the number of fibers per cable (12, 24, ... 144). Circuit equipment investments

[10] The IO facilities cost study assumes Synchronous Optical Network (SONET) design.

[11] Investments per voice grade channel, DS1 and DS3 from COSTPROG are entered in ACES where capital costs and operating expenses are computed. See Section 3.11 for a description of the Automated Cost Extraction System (ACES).

[12] OC3, OC12 and OC48 are bandwidths or transmission rates for SONET transmission facilities. An OC3 facility has the capacity of three DS3 fiber optic circuits. A DS3 circuit equates to 28 DS1 circuits, and a DS1 equals 24 DS0 or voice grade circuits. Thus, an OC3 facility has the nominal capacity to carry 2,016 voice grade circuits. An OC12 has the capacity of four OC3s and an OC48, the capacity of 16 OC3s. Since IO facility costs for dedicated transport are expressed per voice grade channel, per DS1 and per DS3, the capacity versus investment required for each network is important.

are independent of network length, and fiber investment varies depending on route mileage.

- *Network Investment Calculation.* COSTPROG calculates the current investment required to construct each network based on the cost drivers described above and the fixed and per-mile investments. Then, for each A - Z central office combination, the model selects the least cost path of networks between them. After selecting the least cost path, COSTPROG computes the fixed and per mile investments per unit of capacity. Separate unit investments are calculated for a voice grade dedicated channel, DS1 and DS3. The results, for example, consist of the fixed investment per DS1 channel for each A - Z central office combination, and the fiber investment per DS1. The fiber investment is divided by the A - Z air mileage to compute the DS1 investment per air mile.

- *Unit Investment Weighting.* The unit investments vary among the A - Z central office combinations due to several factors - SONET design type, bandwidth, route mileage and others. Average fixed and per mile investments are computed for each zone by weighting the unit investments by the number of circuits between each pairing of offices.

- *Buried and Underground Cable Split and Conduit Loading.* The last step is to split the fiber investment per mile between buried and underground cable types. This is done by applying current percentages of fiber construction costs for these two cable types. Conduit investment also is calculated based on the current ratio of conduit to underground cable construction costs.

The resulting statewide average unit investments for each zone are used in ACES to compute monthly capital costs and operating expenses.

5.5 Common Transport

The Common Transport cost study computes the transport costs for message traffic; i.e., local and toll calling. Costs are expressed *per minute* of calling.

As described for Dedicated Transport, IO facility costs consist of the *fixed costs* of circuit equipment at central offices or termination points of the facilities and *per mile* costs for cable. In the Common Transport cost study, the former are called *termination costs* and the latter are called *facility costs.* Termination costs are expressed per minute of use, and facility costs per minute, per mile. Costs are provided for calling within the three geographic zones and for inter-zone calling. Figure 5.2 illustrates the study results.

Figure 5.2

Common Transport Cost Study Results

Termination Cost / Minute of Use

Geographic Zone	Recurring Cost
1	$0.XXXX
2	$0.XXXX
3	$0.XXXX
Interzone	$0.XXXX

Facility Cost / Minute - Mile

Geographic Zone	Recurring Cost
1	$0.XXXX
2	$0.XXXX
3	$0.XXXX
Interzone	$0.XXXX

Common transport costs are calculated for each zone in the following steps:

- The *monthly fixed cost per DS1* from the Dedicated Transport cost study is divided by 24 voice grade channels per DS1. This provides the *termination cost per voice grade channel.*

- Separately, the *monthly cost per mile for a DS1* from the same study is divided by 24 voice grade channels, yielding the *facility cost per mile* for a voice grade channel.

- Since costs are to be expressed per minute of use, the average minutes of use per month of a voice grade channel must be calculated.

  The capacity of common transport facilities or message trunks between central offices is sized to handle traffic during the busiest hours. There is a maximum of 60 minutes of calling during the busy hour; however, to provide an acceptable grade of service trunk groups are designed to be used less than 100% during the busy hour. The measure of busy hour use is referred to as *trunk group efficiency.* Multiplying 60 minutes times the trunk group efficiency determines the objective minutes of use of trunk groups.

  The objective minutes of use during the busy hour then is divided by the percentage of calling during the busy hour to compute minutes of use per day. This amount is multiplied by the number of business days per month to determine total minutes of use per month.

- Finally, the monthly termination and facility costs per mile are divided by monthly minutes of use to calculate corresponding costs per minute of use.

The resulting costs represent the average cost per minute of use for local or toll calling at any time or day for each geographic zone.

5.6 Other Transport Network Element Costs

As mentioned in Section 5.2, there are three other network elements in the Dedicated Transport cost study. For each network element, Service Area Function (SAF) designs are developed reflecting current transmission technologies, vendor material prices, construction cost loadings and equipment capacities. Investments are calculated on a per unit of capacity basis and entered in ACES to compute monthly capital costs and operating expenses. Non-recurring costs for service activation are developed for each network element based on activity times of work groups involved and direct labor rates.

- *Cross-Connect Costs.* SAF designs are prepared for equipment necessary to connect interconnecting carrier equipment to SWBT facilities for two-wire, four-wire, DS1 and DS3 connections. The equipment includes plug-in equipment, intermediate distribution frame arrangements for the cross-connection, digital test access units and jack panels.

- *Digital Cross-Connect System.* SAF designs are used to develop digital cross-connect system (DCS) investments at the DS0 or voice grade, DS1 and DS3 bandwidth levels. Investments reflect current DCS hardware and plug-in equipment. In addition to monthly costs per DCS port, non-recurring costs are determined for DCS establishment, database modification and reconfiguration.

- *Multiplexing.* Monthly costs are computed for providing multiplexing from DS1 to DS0 and DS3 to DS1 transmission levels. For DS1 to DS0 multiplexing, the current cost of D4 frames and common equipment are used. For DS3 to DS1 multiplexing, M13 multiplexing and plug-in equipment are used in the SAF design.

5.7 Non-Recurring Transport Costs

Non-recurring costs are computed for transport network elements including the costs for service activation and disconnection. For each network element, the work groups involved and their activities are identified. Then, for each activity, the activity time for the first network element on a service order and each additional network element are determined. The activity time for additional network elements excludes, for example, travel time and administrative tasks which are attributed to the first network element.

Activity times are applied to direct labor rates for each work group to calculate activity costs, and these amounts are adjusted by the probability the activity occurs each time a network element is ordered. Activity costs for all work groups involved in activating or disconnecting a network element are summed to compute the non-recurring cost.

Operator Services Costs

6.1 Study Purpose

There are several cost studies related to the operator services which are to be provided to local service providers. The first of these is a basic study of the cost to provide *a second of operator productive time* regardless of the particular operator service, such as assistance in completing local or intraLATA toll calls, tracing calls, etc. Another study determines the costs of handling directory assistance calls. Other studies compute the costs of new operator services which will be provided by Southwestern Bell, such as the "branding" of operator services provided on behalf of other local service providers and providing call rating services. Each of these studies is described in the following sections.

6.2 Operator Work Second Costs

The study estimates the forward-looking cost of a second of operator productive time. Approximately 70% of the *operator cost per work second* is the direct labor cost of an operator - the operator wage, the costs of non-productive time (breaks and paid absence), premium wage costs, benefits and social security taxes, and the costs of first line supervision. Also included are support asset and other miscellaneous direct operator expenses. Labor costs are obtained from the 1996 labor rate for an operator in the state and divided by the number of seconds of productive time in which the operator is occupied handling calls (over 90% of productive time). The 1996 labor costs are inflated to the average costs expected during the 1997 - 1999 study period.

In addition to direct labor costs, the operator cost per work second includes the costs of the switching, trunking, and multiplexing equipment necessary to connect customer calls to operators. Also included are costs for use of switch control units, interactive voice response systems and the Line Information Database. These equipment-related costs account for about 13% of the operator work second cost. Capital costs and operating expenses are included for each network element.

The remaining 17% of the operator work second cost largely consists of state-specific costs for numerous activities necessary to support operator services. For example, some of the major activities include:

- Updating software tables in the Operator Services - Methods group.
- Investigating trouble reports related to operator services facilities.
- Processing contracts in Exchange Carrier Relations.
- Others.

The annual costs of these activities are divided by the annual, statewide quantity of local and IntraLATA toll operator assisted calls, 0-transfer calls and CAMA calls to compute an average cost per call, and this figure then is divided by the average

number of seconds per call to compute the costs per operator work second for these support activities.

6.3 Directory Assistance Costs

This study computes the average cost of a Directory Assistance (DA) call based on the weighted average of four DA call types:

- *Sent paid, coin call.* DA call placed from a coin telephone.
- *Sent paid, Hotel / Motel call.* DA call placed from a telephone in a hotel or motel, and billed to the hotel or motel.
- *Sent paid, non-coin.* DA call placed from a private residence, business or location other than a coin phone or phone located in a hotel or motel. Billing for the DA call, if applicable, is to the calling phone number.
- *Calling card call.* DA calls paid with a calling card.
- *Bill to third number call.* DA call charged to a telephone number other than the calling or called telephone number.

Almost all calls are either *sent paid, non-coin* or *sent paid, coin calls.* The costs of these two call types are very similar.

Approximately 83% of the cost of a sent paid, non-coin or coin call is operator labor cost. The operator labor cost per work second described in Section 6.2 is multiplied times the average seconds per DA call. DA call handling times are about the same for sent paid, non-coin and coin calls, and increase for the other three call types due to the additional time required to obtain customer information and other call handling tasks.

The remaining costs per DA call are equipment-related. They include switching, multiplexing, and other circuit equipment capital costs and operating expenses for network elements necessary to connect customer calls to DA operators. There also is a small cost for the interactive voice response system.

In the case of calling card and billing to third number calls, costs are included for a query of the Line Information Database (LIDB). This adds to the cost of these call types; however, the additional operator time required to handle these calls is the largest contributor to their higher costs.

Finally, the weighting of call types is based on actual 1996 DA call volumes in the state.

6.4 Local and IntraLATA Operator Assistance - Fully Automated

As in the Directory Assistance cost study described in the preceding section, this study computes a weighted average cost per call for operator assistance on a fully automated basis (i.e., a live operator is not involved in the call). There are five operator assistance call types which may occur for local or intraLATA calling. These include:

- Station sent paid coin.
- Station collect.
- Station bill to third party, non-coin.
- Station bill to third party, coin.
- Station calling card.

With the exception of station sent paid coin calls, costs per call among the call types are approximately the same. Station sent paid coin calls are lower than the other call types since these calls do not require a query of the LIDB database and are handled by the end office switch (therefore, do not require transport or additional switching). Costs for the other call types include capital costs and operating expenses for switching, transport and interactive voice response systems, as well as the cost of a LIDB query.

The preceding costs vary with call volumes; i.e., as demand for automated operator assistance calls increase capacity requirements and costs for switching, transport, voice response systems and LIDB increase. In addition to these costs, the study includes significant additional costs for vendor maintenance of switch control units and interactive voice systems used in automated calls and the state-specific costs for support activities described in Section 6.2. These additional, "volume insensitive" costs represent about 30% of the cost of a fully automated operated assistance call.

6.5 Call Trace Costs

Call tracing allows a telephone customer to trace an unwanted call although the name and telephone number of the calling party are not revealed. A record is maintained by Southwestern Bell of successful traces, and when three calls are traced to the same calling number, the local law enforcement agency is informed. Since call tracing primarily requires the time of operators, costs are computed based on an estimate of the number of minutes required to conduct a call trace and the direct labor rate for an operator. The study provides the average cost per call trace.

6.6 External Rating / Reference Costs for Facility-Based Providers

With external rating / referencing, SWBT operators will be able to quote rates on behalf of Independent telcos and local service providers. This study computes costs for non-recurring activities which are necessary to initially and subsequently load databases with local service provider rating and reference information. Estimates

of activity times required of personnel in Operator Services and Customer Services are applied to direct labor rates to compute costs per initial and subsequent load.

6.7 Branding Costs for Facility-Based Providers

Branding for facility-based providers is a new service in which automated telephone equipment will provide recorded announcements to identify a telecommunications company to a caller. Local service providers will be able to provide a distinct recording to identify their company to callers dialing 0+, Directory Assistance and other calls routed to a SWBT operator service system. Similar to the External Rating / Reference service described in Section 6.6, non-recurring costs are developed for initially and subsequently loading local service provider recordings and other information.

Other Network Element Costs

7.1 Overview

The FCC Order requires incumbent local exchange carriers to provide access to a number of unbundled network elements besides local loops, end office switching, transport and operator services.[13] Southwestern Bell has completed cost studies for some of these other network elements, and in this section, a brief description of the studies is provided. For further information, refer to the documentation for each study.

7.2 Tandem Switching

The unbundled tandem switching cost study calculates the cost to Southwestern Bell to provide tandem switching capability throughout its network. The study assumes all forward-looking, digital switching technologies. The Bellcore SCIS model provides tandem switching unit investments which are used in another Bellcore model called the Network Cost Analysis Tool (NCAT). NCAT simulates the handling of various call types through the network and determines the amount of plant investment required to handle calls. This information is used to compute a *tandem switching investment per minute use.* ACES then is used to calculate capital costs and operating expenses associated with the tandem investment. The result of the study is a statewide *tandem switching cost per minute of use.*

7.3 Signaling System 7

Several cost studies have been completed for elements of Southwestern Bell's Signaling System 7 (SS7) network.

- *SS7 Transport.* This study determines the *cost per octet* for use of signal transport points (STPs) and links in the SS7 network. An octet is the measure of usage in a packet data network such as the SS7 network. An STP is a packet switch that routes signaling messages among the points in the SS7 network. SS7 transport is required by local exchange carriers for call processing and other networking functions.

- *STP Port.* The STP port cost study computes the *recurring monthly cost per port* for a termination on a signal transport point through which signaling messages enter Southwestern Bell's signaling network. The study also includes non-recurring costs for activities necessary to establish the port connection. These include installation, code addition and translation activities.

[13] See paragraph 51.319 of the FCC Order (Appendix B, pages B-20 - B24) regarding specific unbundling requirements.

- *Local Service Provider to SS7 STP Cross-Connect.*

- *Queries.* Costs are determined for several types of SS7 queries on a *cost per query* basis. The first, a Line Information Data Base (LIDB) query, involves a request routed from Southwestern Bell's STP to a service control point (SCP) where a data base is queried to validate a subscriber's credit card number or for third-party and collect calls. A Calling Name query also involves the use of the STP and SCP and is used in providing CallerID service. A third query type is the Toll Free Query needed to identify the "real" telephone number associated with a toll free telephone number. Non-recurring costs also are computed for service order processing to establish the capability for LIDB queries.

- *LIDB / Service Management System (SMS).* The LIDB / Service Management System is a computer system which provides a number of administrative functions related to the update, maintenance and protection of the LIDB. This cost study develops costs for these various administrative functions.

The Bellcore Common Channel Signaling Cost Information System (CCSCIS) is used extensively in the SS7 cost studies to compute investments per unit of demand (octets, ports and queries). ACES is used to compute recurring capital costs and operating expenses as in other network element cost studies. Non-recurring costs are calculated based on specific activity times and labor rates of personnel performing activities.

7.4 Unbundled Service Order

This study computes the non-recurring costs attributable to processing service orders or Local Service Requests (LSRs) for unbundled network elements. LSR costs are distinguished for simple versus complex orders.

- *Simple.* LSRs which can be processed by a service representative in the Local Service Provider Service Center (LSPSC) *without* the involvement of other work groups. LSRs for loops, analog ports and cross-connects can be processed by a service representative.

- *Complex.* LSRs requiring activities by the LSPSC and other work groups, such as Network Sales Support and the Circuit Provisioning Center. Orders for DS1 entrance facilities, dedicated transport and other unbundled network elements with more complex provisioning involve Complex LSRs.

Separate LSR costs are computed for *four order types - new service, change, record and disconnect.* New service and disconnect LSRs apply when service for unbundled network elements is initiated or discontinued, respectively. A change LSR applies when service is modified for existing service, and record LSRs apply

when a change in service is requested without a physical change in network elements, such as a change in customer records. Costs differ among the LSR types primarily due to differences in the labor required to complete the orders.

LSR costs consist of the costs of three resources:

- *Labor.* Costs include salaries and wages, benefits and other direct labor-related costs. Labor costs are computed simply by applying direct labor rates to estimates of the activity times required to process LSRs.

- *Data Processing - Central Processing Unit (CPU).* These are costs of computers used to access records and prepare LSRs. Six computer systems are involved in LSR processing, and costs are computed for each based on estimates of the seconds of CPU time required for each LSR and a cost per CPU second of use. CPU costs include hardware costs, costs of employees operating computer systems, software costs and other direct CPU costs.

- *Data Processing - Execute Channel Program (EXCP).* EXCP costs relate to disk and tape storage equipment used in LSR processing. Cost components are similar to those for CPU costs.

Labor, CPU and EXCP costs are computed separately for negotiating and typing the LSR based on the resources consumed in each activity. Labor, CPU and EXCP costs are calculated at 1996 cost levels and inflated based on the average inflation rate expected during the next three years - 1997 - 1999.

Since several unbundled network elements may be ordered, LSR costs are developed reflecting a mix the of network elements. For example, in computing the cost of a Simple New Service LSR, the costs of processing orders for an analog port, a loop and a cross-connect are weighted by their expected frequency to compute an average Simple New Service LSR cost. This approach is used for all LSR types.

7.5 Maintenance of Service

SWBT expects local service providers to report suspected failures of its network elements. If there is a network element failure, SWBT will repair the network element as part of its normal charges for the network element. However, if a technician is dispatched to the end user's premises or a SWBT central office and the trouble is not caused by SWBT facilities, the Company will charge for "time and materials." This is referred to as a Maintenance of Service charge.

This cost study computes the costs of the activities necessary to receive trouble reports, dispatch technicians and isolate troubles when Maintenance of Service applies. Costs are calculated for:

- The *first half hour* of work, including administrative activities, technician travel and the first half hour of the technician's time.

- Each *additional half hour* increment of the technician's time.

Since technicians may be called out at different times, costs also are computed for *basic time* during normally scheduled working hours, *overtime* and *premium time.*

As described in Section 7.4, Maintenance of Service costs include the labor costs as well as data processing costs for central processing units and disk and tape storage equipment. Systems used in Maintenance of Service activities include the Loop Maintenance Operations System (LMOS) and the Work and Force Administration / Dispatch Out system. Labor and data processing costs are based on the labor, CPU and data storage resources consumed during the first and each additional half hour of work.

7.6 Operational Support Systems

SWBT has a numerous systems used for service order processing, provisioning, maintenance and repair, and customer billing. Local service providers (LSPs) will be provided access to these systems. The Operational Support Systems (OSS) cost study computes the costs of providing access to OSS.

- *Ongoing Operational Costs.* Once OSS access is established, there will be several ongoing operational costs. These include costs for activities related to customer support, managing the EASE Tandem system which will give LSPs access to customer information, support of intelligent work stations and system security. The study provides a total monthly cost estimate for these miscellaneous ongoing activities based on estimates of annual labor hours and direct labor rates.

- *Ongoing Helpdesk Costs.* This is the total monthly labor cost of the LSP Helpdesk. The cost is based on the number of hours per month required by the Information Systems organization to staff the Helpdesk and the associated direct labor rate.

- *Ongoing Remote Access Facility Costs.* Remote access facilities costs include capital costs and operating expenses for the plant necessary to provide LSP access to SWBT OSS. The plant includes modems, routers, voice response units and others. The total plant required for remote access facilities is identified, and total monthly capital costs and operating expenses for the plant are computed. This amount is divided by the capacity (in ports) of remote access facilities to arrive at a monthly plant-related cost per port.

  In addition to the plant-related cost per port, a separate estimate is developed of the additional labor costs to support the remote access facilities. This is based on an estimate of the annual hours required for support and direct labor rates. These additional labor-related costs are divided by port capacity.

Capital Costs

8.1 Definition of Capital Costs

Capital costs include *depreciation expense*, the *cost of money* and *income taxes*.

- *Depreciation* is the annual expense of recovering the original construction cost of telephone plant, less any net salvage, over the service life of the plant. Depreciation is computed for each plant account based upon the prospective lives and expected net salvages.

- *Cost of money* is the annual return required on investor supplied capital used to construct telephone plant. The return requirement includes the prospective costs of debt and equity, weighted by the proportion of debt and equity anticipated in Southwestern Bell's forward-looking capital structure.

- *Income taxes* represent the amount of income taxes which would be owed on taxable income from revenues sufficient to cover the cost of equity after taxes.

When revenues from offering a network element are sufficient to recover its operating expenses and capital costs, revenues are said to recover all costs, including the costs of capital recovery and the return required on investor capital.

8.2 Capital Cost Calculation

Figure 8.1 provides a simplified example of capital cost calculations for a single item of telephone plant with a five year service life. The results of the calculations shown on the last three lines are factors which are multiplied times the original cost of plant or gross investment to compute capital costs.

- *Plant investment and net salvage.* The original cost of telephone plant or *plant investment* is incurred at the beginning of the plant's *service life.* At the end of the service life, the Company may realize some value, *gross salvage*, in disposing of the plant. This amount is reduced by any *cost of removal*, yielding a *net salvage* value. Service lives and net salvages expressed as a percentage of plant investment are estimated annually for each plant account based on the forward-looking lives and salvages expected for telephone equipment. They vary somewhat among the states in which Southwestern Bell operates.

- *Depreciation rate, depreciation expense, depreciation reserve and net investment.* The *depreciation rate* equals 100% of plant investment less the percentage net salvage, divided by the service life. *Depreciation expense* is the product of the depreciation rate and plant investment. Depreciation rates vary among plant accounts.

Over the life of the plant, depreciation is accrued in a reserve reflecting the gradual recovery of the initial capital investment. The difference between plant investment and the *depreciation reserve* equals the *net investment.* A annual return must be earned on the remaining investor capital in the plant.

- *Costs of debt and equity, debt ratio and the cost of money.* Funds for telephone plant construction come from depreciation accruals or cash from current operations used to recover prior plant investment, capital from the issuance of bonds and stock, and retained earnings. (As described below, deferred income taxes also are used to fund capital investment.)

  Debt capital has an interest payment obligation referred to as the *cost of debt,* and equity capital from stocks and retained earnings has a return requirement or *cost of equity.* The mix of debt and equity capital, measured by the *debt ratio* or ratio of debt to debt and equity capital, determines the composite *cost of money.* Southwestern Bell estimates its forward-looking costs of debt and equity and debt ratio to determine the cost of money used in the unbundled network element cost studies.

  The annual cost of money equals the cost of money percentage applied to the net investment. As the net investment declines, the cost of money or return requirement also declines.

- *Income tax rate, taxable income required and income tax expense.* The *income tax rate* is the effective federal and state income tax rate. In order to realize income after taxes sufficient to cover the cost of equity requires a level of *taxable income* equal to the cost of equity divided by (1 - income tax rate).[14] The *income tax expense* is the income tax rate times the taxable income requirement.

The capital costs vary each year as net investment in telephone plant declines. In order to "levelize" the series of capital costs, they are brought to the present using *present worth factors* computed at the cost of money, and then spread back over the service life using an *annuity factor.*[15] After these steps are completed, the levelized capital costs are divided by the original plant cost to compute levelized capital cost factors. These factors are then used in ACES to compute capital costs for each type of plant.

Capital cost calculations actually are more complicated than those shown in Figure 8.1. Several additional factors are take into consideration. For example,

[14] Since interest expense is tax deductible, there is no need to "gross up" the cost of debt to a pre-taxable income amount.

[15] Capital costs also can be computed over planning periods less than the service life by computing the present worth and annuity of capital costs for shorter periods of time.

- *Effects of accelerated tax depreciation.* The use of accelerated tax depreciation and the normalization of deferred income taxes reduces investor-supplied capital in telephone plant. Recognizing accelerated tax depreciation lowers the cost of money and associated income taxes.

- *Multiple units of plant, survivor curves and method of depreciation.* Unlike the earlier example, telephone plant normally consists of multiple units of plant placed during a year, and these units usually have different survival patterns, with some retiring before others. The plant placed in a single year is subject to equal life group depreciation. These factors require modeling the timing of plant investment, retirements, annual depreciation and net investment.

Southwestern Bell uses the CAPCOST model to reflect these and other factors in computing capital costs. CAPCOST is licensed by Bellcore to local exchange carriers and has been in use in the telephone industry for many years. The variables described above are the key input variables to the CAPCOST model.

Figure 8.1 - *Illustrative.*

	Line	Factor	End of Year 0	1	2	3	4	5	Source
Plant Investment	1		$ 1,000						Investment Study
Gross Salvage	2							$ 200	Engineering
Cost of Removal	3							$ 100	Engineering
Net Salvage	4							$ 100	Ln. 2 - Ln. 3
Depreciation Rate	5	18.00%							(100% - NS%) / S.L.
Depreciation Expense	6			$ 180	$ 180	$ 180	$ 180	$ 180	Ln. 1 X Ln. 5
Depreciation Reserve	7		$ -	$ 180	$ 360	$ 540	$ 720	$ -	Cumulative Ln. 6
Net Investment	8		$ 1,000	$ 820	$ 640	$ 460	$ 280	$ -	Ln. 1 - Ln. 7
Cost of Debt	9	8.0%							Finance
Cost of Equity	10	12.0%							Finance
Debt Ratio	11	50.0%							Finance
Cost of Money	12	10.0%							Ln. 9 X Ln. 11 + (1 - Ln. 11)X Ln. 10
Cost of Money	13			$ 100	$ 82	$ 64	$ 46	$ 28	Ln. 8 X Ln. 12
Income Tax Rate	14	40.0%							Finance
Fraction Equity of COM	15	60.0%							(Ln. 12 - (Ln. 9 X Ln. 11)) / Ln. 12
Cost of Equity	16			$ 60	$ 49	$ 38	$ 28	$ 17	Ln. 13 X Ln. 15
Taxable Income Required	17			$ 100	$ 82	$ 64	$ 46	$ 28	Ln. 16 / (1 - Ln. 14)
Income Tax Expense	18			$ 40	$ 33	$ 26	$ 18	$ 11	Ln. 14 X Ln. 17
Present Worth Factors	19			0.909	0.826	0.751	0.683	0.621	1 / (1 + Ln. 12) ^ Year
Present Worths									
Depreciation	20			$ 164	$ 149	$ 135	$ 123	$ 112	Ln. 6 X Ln. 19
Cost of Money	21			$ 91	$ 68	$ 48	$ 31	$ 17	Ln. 13 X Ln. 19
Income Taxes	22			$ 36	$ 27	$ 19	$ 13	$ 7	Ln. 18 X Ln. 19
Sum of Present Worths									
Depreciation	23	$ 682							Sum of Ln. 20
Cost of Money	24	$ 256							Sum of Ln. 21
Income Taxes	25	$ 102							Sum of Ln. 22
Annuity Factor	26	0.264							1 / Sum of Ln. 19
Levelized Capital Costs									
Depreciation	27	$ 180							Ln. 23 X Ln. 26
Cost of Money	28	$ 67							Ln. 24 X Ln. 26
Income Taxes	29	$ 27							Ln. 25 X Ln. 26
Capital Cost Factors									
Depreciation	30	18.0%							Ln. 27 / Ln. 1
Cost of Money	31	6.7%							Ln. 28 / Ln. 1
Income Taxes	32	2.7%							Ln. 29 / Ln. 1

NS% - Net Salvage %
S.L. - Service Life

Investment Loadings

9.1 Definition of Investment Loadings

In performing unbundled network element cost studies, much of the effort goes to computing the *primary plant construction costs.* These include material costs of major equipment components, vendor engineering and installation labor costs, and others. The studies also focus on the *primary plant accounts*, such as cable and wire facilities, central office switching and central office transmission. A significant portion of the investment necessary to provide network elements is attributable to other construction costs, such as sales taxes, telco engineering and labor, miscellaneous materials, power equipment and buildings. These construction costs typically are included in the cost study by using *investment loading factors.*

Investment loading factors represent the ratio of these additional costs to the primary plant construction costs, such as the ratio of power equipment cost for switching systems to the cost of the switching system itself. Another investment loading for buildings is the ratio of investment in network buildings to the total investment in switching, circuit and other equipment housed in the buildings. They are used to estimate the additional plant investment required to provide network elements and are introduced in the study in ACES.

9.2 Description

Seven investment loading factors are used in the unbundled network element cost studies. The factors are based on special studies of financial and engineering records and vary by state. Each factor is briefly described below.

- *Ratio of material to total EF&I and sales tax factor.* These two factors are used to compute sales taxes on central office switching, central office transmission, operator systems and general purpose computers. The first factor is applied to vendor charges for plant, including vendor engineering and labor, to estimate the cost of materials on which sales taxes apply. The factors are based on a special study of actual vendor material purchases during the most recent three year period and sales taxes paid in the previous year.

- *Telco engineering and plant labor factors.* These factors are used to compute the additional investment required for Southwestern Bell's engineering and labor in constructing central office switching, central office transmission and general purpose computer plant. The factors are based on special studies for the most recent three year period.

- *Sundry & miscellaneous factor.* This factor accounts for interest during construction, contracted labor and other miscellaneous costs in placing central office switching, central office transmission and general purpose

computers. As with the previous factors, this factor is based on a study of financial records during a recent three year period.

- *Power equipment factor.* The power equipment factor is used to compute the costs of electrical equipment, such as generators, batteries, etc., needed to operate central office switching, central office transmission, general purpose computers and operator systems. It is based on an analysis of power equipment and costs in the Separations regulatory accounting process.

- *Building factor.* A building factor is used to calculate the forward-looking investment in building space needed for central office switching, transmission and operator systems equipment. The factor is based on the ratio of the current cost of network buildings to the current cost of switching, circuit and operator systems.

9.3 Inflation Factors

Unbundled network element costs reflect telephone plant investment and operating expenses assuming forward-looking network technologies, construction costs and operating labor costs. Material, labor and other cost data used in the cost analysis, though, reflect recent and current price levels during the 1995 - 1996 timeframe. Inflation factors are used to reflect inflation in prices from 1995 - 1996 to the present and, if appropriate, to the mid-point of a future planning period. Southwestern Bell cost studies reflect costs during a 1996 - 1998 or 1999 planning period, depending on the study.

Operating Expense Factors

10.1 Definition of Operating Expenses

Operating expenses are the *recurring* and *non-recurring* plant specific and plant non-specific costs attributable to a network element. Recurring expenses are computed using operating expense factors applied to network element investments, although recurring expenses may be computed based on special studies of recurring work activities and associated costs. Non-recurring operating expenses, which typically include service order and service activation costs, are computed based on studies of work activities and costs.

10.2 Description of Operating Expense Factors

There are *four* operating expense factors used in cost studies.

- *Maintenance factor.* The maintenance factor includes *plant specific* expenses for a type of plant (expenses of maintaining, repairing and rearranging telephone plant in service), power expense, and testing expense. Special studies are performed to identify the portions of power and testing expenses attributable to switching, circuit, cable and wire, and other types of plant. Maintenance factors vary by plant account recognizing, for example, that aerial and underground cable have different maintenance requirements and costs.

  The maintenance factors are computed as the ratio of prior year maintenance expenses to average book investment, *adjusted to a current cost basis.* Current cost to book cost ratios are used to express plant investments in terms of current costs. Maintenance factor studies are performed annually using information from Southwestern Bell financial accounting systems.

- *Support asset expense factor.* This factor is used to compute network element *plant non-specific expenses*, such as network administration, plant operations administration and engineering expenses, and *support asset costs* attributable to the network element. There are separate expense factors for central office switching, central office transmission, cable and wire facilities, public telephone and other terminal equipment. The factor is based on the ratio of support asset expenses during the previous year to average plant investment, adjusted to a current cost basis.

- *Miscellaneous expense factor.* A single factor is applied to all plant types to compute miscellaneous expenses for property taxes, franchise taxes and other operating taxes. The factor also is referred to as the *ad valorem tax factor.*

- *Commission assessment.* This factor is used to compute the expenses for other operating taxes in account 7240.22. The factor is developed as the ratio of expenses in this account to intrastate operating revenues (less the expense amount). The commission assessment is used to "gross-up" the total of network element capital costs and operating expenses by an amount sufficient to recover the revenue-related other operating expenses.

The operating expense factors are entered in ACES and used to calculate recurring operating expenses. (See Section 3.11.)

Forward-Looking Common Costs

11.1 Definition of Forward-Looking Common Costs

The total element long run incremental costs of network elements include only costs directly attributable to the individual network elements. There are substantial resources and business activities which are not directly attributable to a single network element, but rather are common to network elements. The costs of these resources and activities also must be recovered for the business to sustain itself. In its Order, the FCC recognized the need for unbundled network element prices to recover a "reasonable allocation" of *forward-looking common costs* which it defined as,

> "economic costs efficiently incurred in providing a group of elements or services which may include all elements or services provided by the incumbent LEC that cannot be attributed directly to individual elements or services."[16]

The FCC also indicated forward-looking common costs are to exclude retail costs. Southwestern Bell's methodology for computing these costs described in the next section is consistent with the FCC's definition and requirements for a reasonable allocation of common costs.

11.2 Common Cost Calculation and Allocation

The forward-looking common cost study computes a *common cost allocator* which is multiplied times each network element's TELRIC to calculate the amount of common costs to be attributed to the network element. The common cost allocator is the *ratio of common costs to total expenses.*

More precisely, the allocator equals total common costs, less common costs allocable to the retail business, divided by total operating expenses excluding the total common costs. When applied to network element costs, excluding common costs, it provides a reasonable allocation of common costs allocable to wholesale operations.

The steps in the study are as follows:

- *Accumulate Total Common Costs.* Corporate operations expenses for 1995 are totaled. These include total expenses in accounts 6711, 6712 and 6721 - 6728. The costs of support assets used by employees whose salaries appear in the Corporate operations expense accounts are added to this amount.

[16] FCC Order, paragraph 51.505 (c), Appendix B, page B-30.